



TFT LCD Approval Specification

MODEL NO.: N156B6-L08

Customer : Lenovo International

Approved by : _____

Note : Quanta

| 核准時間 | 部門 | 審核 | 角色 | 投票 |
|------------------------|-------------|-------------------------------------|----------------------|--------|
| 2009-09-29 09:09:33 | NB 產品管理處 | <div>方 2009.09.29 健 穎</div> | Director (deputy) | Accept |



Doc No.: 400035521
Issued Date: Sep. 10, 2009
Model No.: N156B6-L08

Approval**- CONTENTS -**

| | |
|---|----|
| REVISION HISTORY | 3 |
| 1. GENERAL DESCRIPTION | 4 |
| 1.1 OVERVIEW | |
| 1.2 FEATURES | |
| 1.3 APPLICATION | |
| 1.4 GENERAL SPECIFICATIONS | |
| 1.5 MECHANICAL SPECIFICATIONS | |
| 2. ABSOLUTE MAXIMUM RATINGS | 5 |
| 2.1 ABSOLUTE RATINGS OF ENVIRONMENT | |
| 2.2 ELECTRICAL ABSOLUTE RATINGS | |
| 3. ELECTRICAL CHARACTERISTICS | 7 |
| 3.1 TFT LCD MODULE | |
| 3.2 BACKLIGHT UNIT | |
| 4. BLOCK DIAGRAM | 10 |
| 4.1 TFT LCD MODULE | |
| 4.2 BACKLIGHT UNIT | |
| 5. INPUT TERMINAL PIN ASSIGNMENT | 11 |
| 5.1 TFT LCD MODULE | |
| 5.2 TIMING DIAGRAM OF LVDS INPUT SIGNAL | |
| 5.3 COLOR DATA INPUT ASSIGNMENT | |
| 5.4 EDID DATA STRUCTURE | |
| 6. CONVERTER | 17 |
| 6.1 ABSOLUTE MAXIMUM RATINGS | |
| 6.2 RECOMMENDED OPERATING RATINGS | |
| 7. INTERFACE TIMING | 19 |
| 7.1 INPUT SIGNAL TIMING SPECIFICATIONS | |
| 7.2 POWER ON/OFF SEQUENCE | |
| 8. OPTICAL CHARACTERISTICS | 22 |
| 8.1 TEST CONDITIONS | |
| 8.2 OPTICAL SPECIFICATIONS | |
| 9. PRECAUTIONS | 26 |
| 9.1 HANDLING PRECAUTIONS | |
| 9.2 STORAGE PRECAUTIONS | |
| 9.3 OPERATION PRECAUTIONS | |
| 10. PACKING | 27 |
| 10.1 CARTON | |
| 10.2 PALLET | |
| 11. DEFINITION OF LABELS | 29 |
| 11.1 CMO MODULE LABEL | |
| 11.2 CARTON LABEL | |
| 12. INSPECTION STANDARDS FOR LCD MOUDULES | 31 |

**CHI MEI**
OPTOELECTRONICS CORP.Doc No.: 400035521
Issued Date: Sep. 10, 2009
Model No.: N156B6-L08**Approval****REVISION HISTORY**

| Version | Date | Page (New) | Section | Description |
|----------|---------------|---------------|---------|---|
| Ver. 3.0 | May.22, 2009 | All | All | Approval spec 3.0 was first issued for N156B6-L08 for Lenovo JP |
| Ver. 3.1 | Jun. 22, 2009 | 15 | 5.4 | EDID DATA STRUCTURE |
| Ver. 3.2 | Sep, 10, 2009 | 37 | Drawing | Update the outline drawing with FPC Mylar tape attachment |

1. GENERAL DESCRIPTION

1.1 OVERVIEW

N156B6-L08 is a 15.6" (15.547" diagonal) TFT Liquid Crystal Display module with LED Backlight unit and 40 pins LVDS interface. This module supports 1366 x 768 HD mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction.

1.2 FEATURES

- HD (1366 x 768 pixels) resolution
- 3.3V LVDS (Low Voltage Differential Signaling) interface with 1 pixel/clock
- WLED

1.3 APPLICATION

- TFT LCD Notebook

1.4 GENERAL SPECIFICATIONS

| Item | Specification | Unit | Note |
|--------------------|--|-------|------|
| Active Area | 344.232 (H) x 193.536 (V) (15.547" diagonal) | mm | (1) |
| Bezel Opening Area | 348.43 (H) x 197.74 (V) | mm | |
| Driver Element | a-si TFT active matrix | - | - |
| Pixel Number | 1366 x R.G.B. x 768 | pixel | - |
| Pixel Pitch | 0.252 (H) x 0.252 (V) | mm | - |
| Pixel Arrangement | RGB vertical stripe | - | - |
| Display Colors | 262,144 | color | - |
| Transmissive Mode | Normally white | - | - |
| Surface Treatment | Hard coating (3H), Glare | - | - |

1.5 MECHANICAL SPECIFICATIONS

| Item | | Min. | Typ. | Max. | Unit | Note |
|-------------|---------------|-------|-------|-------|------|------|
| Module Size | Horizontal(H) | 358.8 | 359.3 | 359.8 | mm | (1) |
| | Vertical(V) | 209 | 209.5 | 210 | mm | |
| | Thickness(T) | - | 5.2 | 5.5 | mm | |
| Weight | | --- | 430 | 445 | g | - |

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.



2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

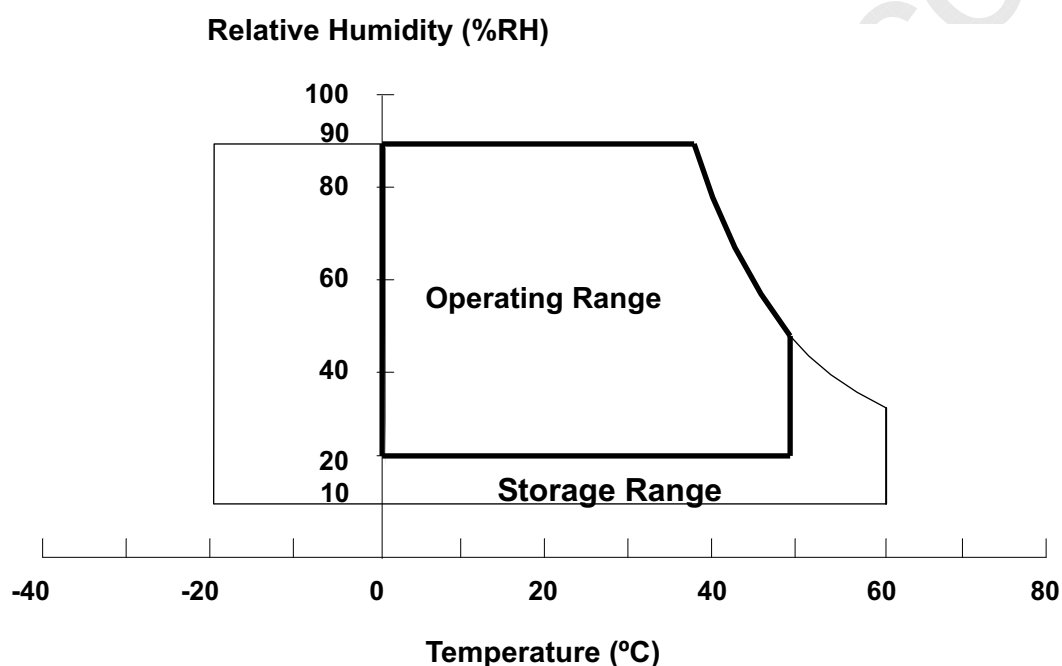
| Item | Symbol | Value | | Unit | Note |
|-------------------------------|------------------|-------|-------|------|----------|
| | | Min. | Max. | | |
| Storage Temperature | T _{ST} | -20 | +60 | °C | (1) |
| Operating Ambient Temperature | T _{OP} | 0 | +50 | °C | (1), (2) |
| Shock (Non-Operating) | S _{NOP} | - | 220/2 | G/ms | (3), (5) |
| Vibration (Non-Operating) | V _{NOP} | - | 1.5 | G | (4), (5) |

Note (1) (a) 90 %RH Max. (Ta <= 40 °C).

(b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).

(c) No condensation.

Note (2) The temperature of panel surface should be 0 °C min. and 60 °C max.



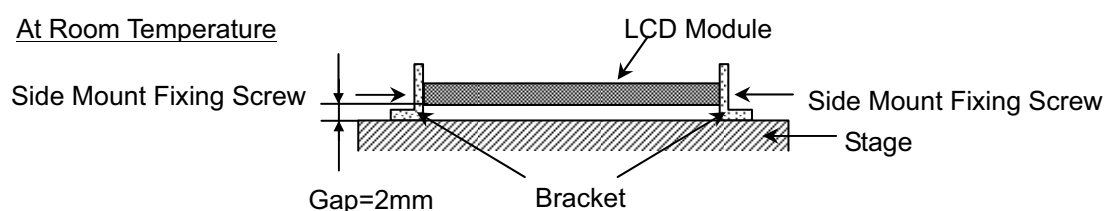
Note (3) 1 time for $\pm X$, $\pm Y$, $\pm Z$. for Condition (220G / 2ms) is half Sine Wave,.

Note (4) 10~500 Hz, 0.5hr/cycle 1cycle for X,Y,Z

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:

At Room Temperature





2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

| Item | Symbol | Value | | Unit | Note |
|----------------------|-----------------|-------|----------------------|------|------|
| | | Min. | Max. | | |
| Power Supply Voltage | V _{CC} | -0.3 | +4.0 | V | (1) |
| Logic Input Voltage | V _{IN} | -0.3 | V _{CC} +0.3 | V | |

2.2.2 BACKLIGHT UNIT

| Item | Symbol | Value | | Unit | Note |
|------------------------------------|----------------|-------|------|------|----------|
| | | Min. | Max. | | |
| LED Light Bar Power Supply Voltage | V _L | -40 | 28 | V | (1), (2) |
| LED Light Bar Power Supply Current | I _L | 0 | 150 | mA | |

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for LED (Refer to 3.2 for further information).

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

 $T_a = 25 \pm 2^\circ\text{C}$

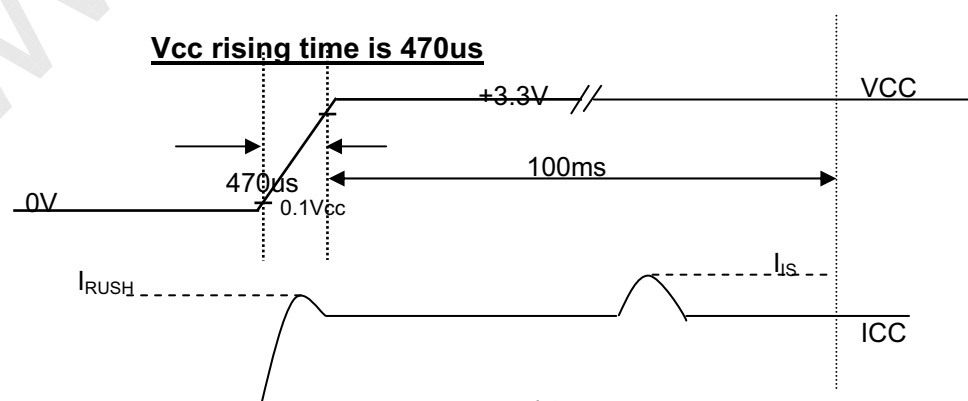
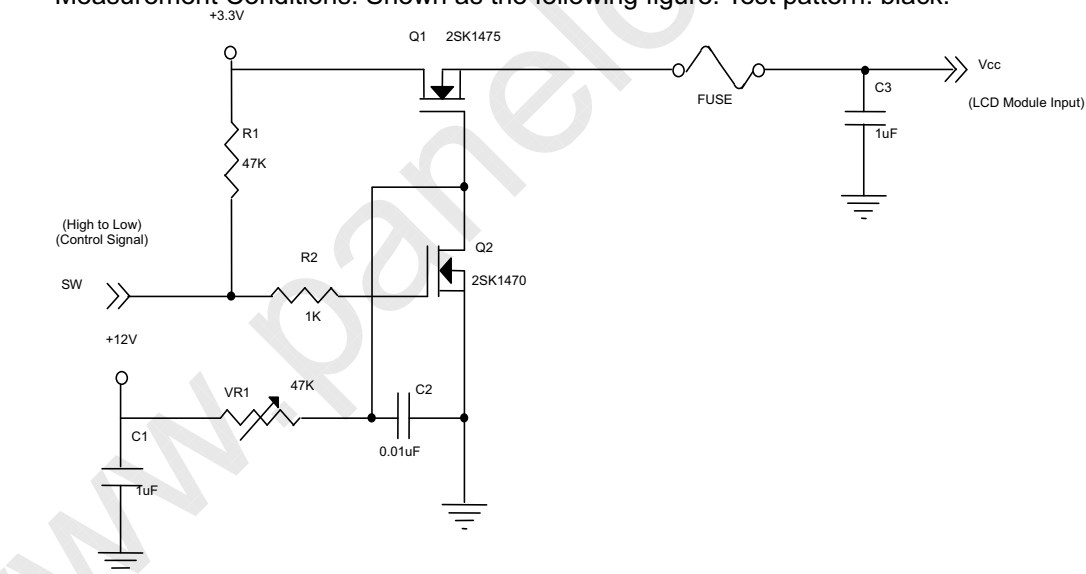
| Parameter | | Symbol | Value | | | Unit | Note |
|--|-------|-----------------------|-------|------|-------|------|-------------------------------|
| | | | Min. | Typ. | Max. | | |
| Power Supply Voltage | | V _{CC} | 3.0 | 3.3 | 3.6 | V | - |
| Ripple Voltage | | V _{RP} | - | 50 | | mV | - |
| Rush Current | | I _{RUSH} | - | - | 1.5 | A | (2) |
| Initial Stage Current | | I _{IS} | - | - | 1.0 | A | (2) |
| Power Supply Current | White | - | 240 | 260 | 280 | mA | (3)a |
| | Black | - | 350 | 380 | 400 | mA | (3)b |
| LVDS Differential Input High Threshold | | V _{TH(LVDS)} | - | - | +100 | mV | (5), V _{CM} =1.2V |
| LVDS Differential Input Low Threshold | | V _{TL(LVDS)} | -100 | - | - | mV | (5) V _{CM} =1.2V |
| LVDS Common Mode Voltage | | V _{CM} | 1.125 | - | 1.375 | V | (5) |
| LVDS Differential Input Voltage | | V _{ID} | 100 | - | 600 | mV | (5) |
| Terminating Resistor | | R _T | - | 100 | - | Ohm | - |
| Power per EBL WG | | P _{EBL} | - | 2.04 | - | W | (4) |

Note (1) The ambient temperature is $T_a = 25 \pm 2^\circ\text{C}$.

Note (2) I_{RUSH} : the maximum current when V_{CC} is rising

I_{IS} : the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure. Test pattern: black.



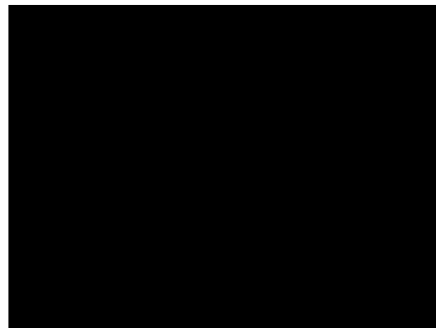
Note (3) The specified power supply current is under the conditions at $V_{CC} = 3.3\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, DC Current and $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



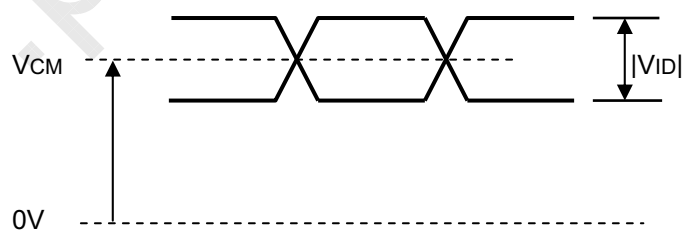
Active Area

Note (4) The specified power are the sum of LCD panel electronics input power and the converter input power. Test conditions are as follows.

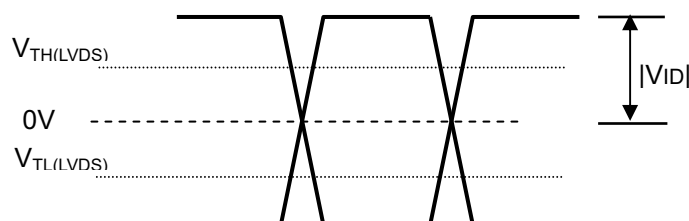
- (a) $V_{CC} = 3.3\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, $f_v = 60\text{ Hz}$,
- (b) The pattern used is a black and white 32 x 36 checkerboard, slide #100 from the VESA file "Flat Panel Display Monitor Setup Patterns", FPDMSU.ppt.
- (c) Luminance: 60 nits.

Note (5) The parameters of LVDS signals are defined as the following figures.

Single Ended



Differential

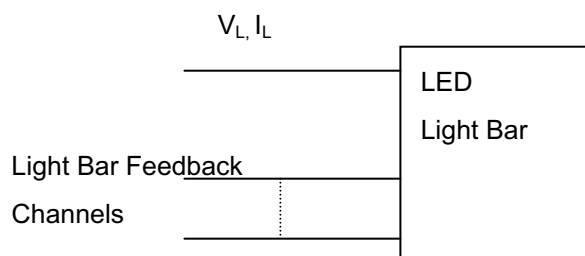


3.2 BACKLIGHT UNIT

Ta = 25 ± 2 °C

| Parameter | Symbol | Value | | | Unit | Note |
|------------------------------------|-----------------|-------|-------|------|------|---------------------|
| | | Min. | Typ. | Max. | | |
| LED Light Bar Power Supply Voltage | V _L | 23.2 | 25.6 | 28 | V | (1),(2) (Duty 100%) |
| LED Light Bar Power Supply Current | I _L | 114 | 120 | 126 | mA | |
| Power Consumption | P _L | 2.65 | 3.072 | 3.53 | W | (3), (Duty 100%) |
| LED Life Time | L _{BL} | 15000 | - | - | Hrs | (4) |

Note (1) LED light bar configuration is shown as below.



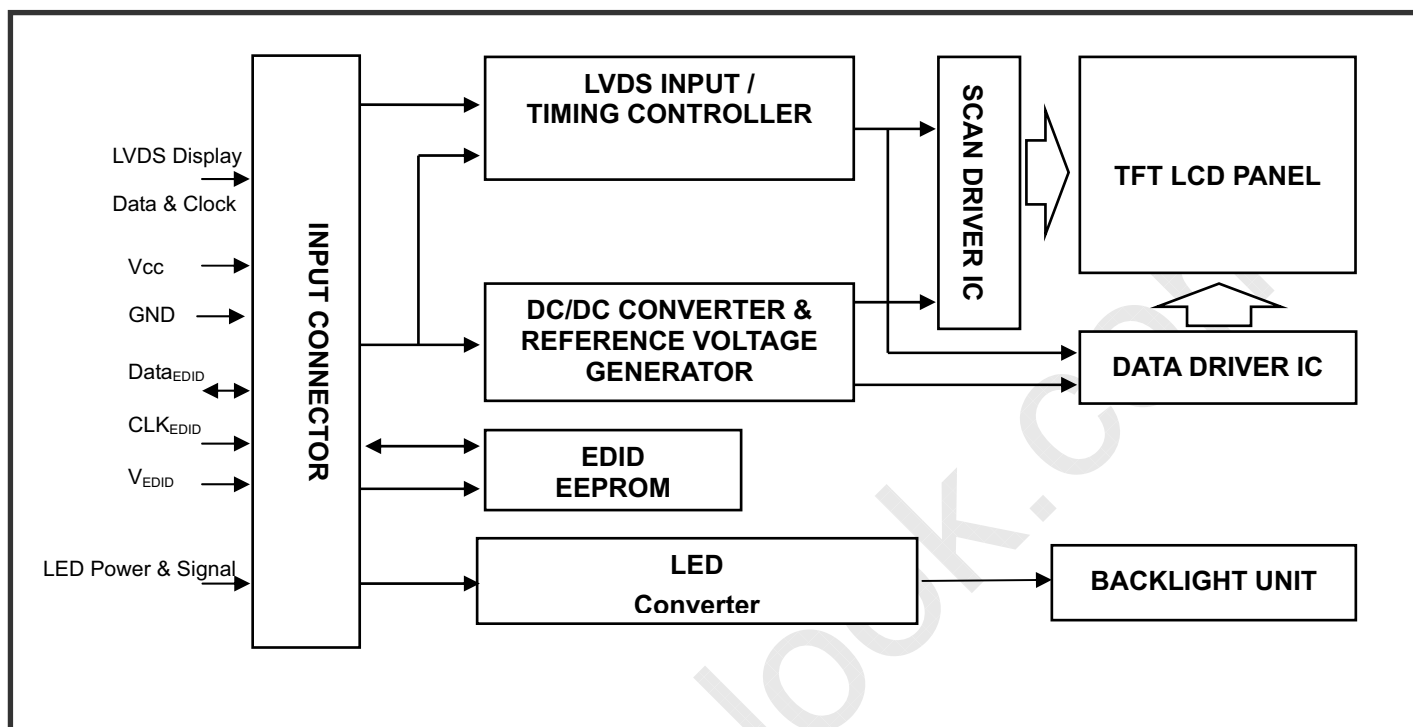
Note (2) For better LED light bar driving quality, it is recommended to utilize the adaptive boost converter with current balancing function to drive LED light-bar.

Note (3) $P_L = I_L \times V_L$

Note (4) LED Lifetime was defined as the time when it continues to operate under the conditions at Ta=25±2 °C and I_L = 20 mA(Per EA) until the brightness becomes ≤ 50% of its original value.

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE





5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

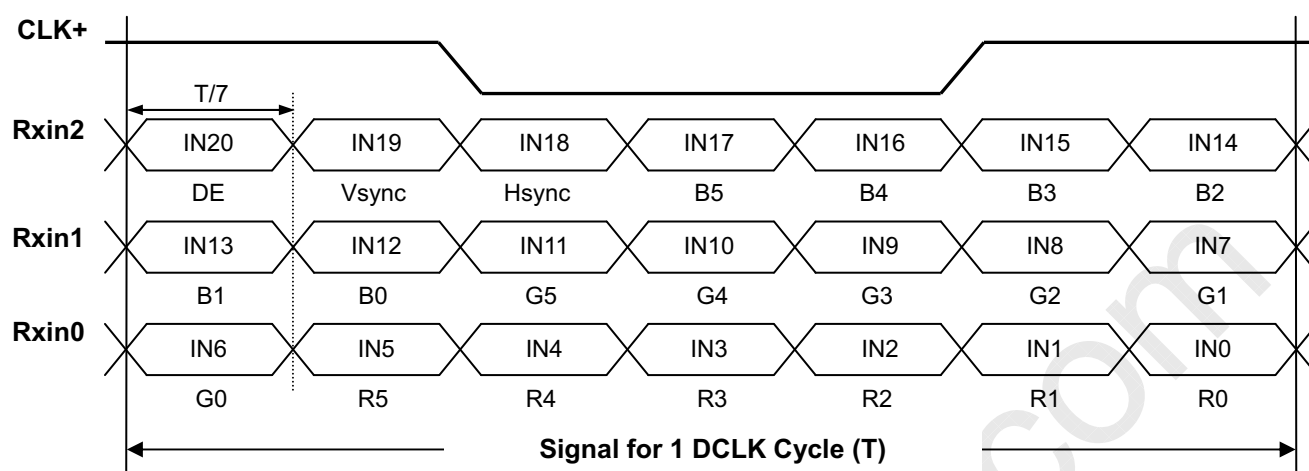
| Pin | Symbol | Description | Polarity | Remark |
|-----|----------------------|-------------------------------|----------|-------------------------|
| 1 | Reserve | Non-Connection use by CMO | | |
| 2 | Vcc | Power Supply +3.3 V (typical) | | |
| 3 | Vcc | Power Supply +3.3 V (typical) | | |
| 4 | V _{EDID} | DDC 3.3V Power | | DDC 3.3V Power |
| 5 | Reserve | Non-Connection use by CMO | | |
| 6 | CLK _{EDID} | DDC Clock | | DDC Clock |
| 7 | DATA _{EDID} | DDC Data | | DDC Data |
| 8 | Rxin0- | LVDS Differential Data Input | Negative | R0~R5, G0 |
| 9 | Rxin0+ | LVDS Differential Data Input | Positive | |
| 10 | Vss | Ground | | |
| 11 | Rxin1- | LVDS Differential Data Input | Negative | G1~G5, B0, B1 |
| 12 | Rxin1+ | LVDS Differential Data Input | Positive | |
| 13 | Vss | Ground | | |
| 14 | Rxin2- | LVDS Differential Data Input | Negative | B2~B5, DE, Hsync, Vsync |
| 15 | Rxin2+ | LVDS Differential Data Input | Positive | |
| 16 | Vss | Ground | | |
| 17 | CLK- | LVDS Clock Data Input | Negative | LVDS Level Clock |
| 18 | CLK+ | LVDS Clock Data Input | Positive | |
| 19 | Vss | Ground | | |
| 20 | NC | Non-Connection | | |
| 21 | NC | Non-Connection | | |
| 22 | Vss | Ground | | |
| 23 | NC | Non-Connection | | |
| 24 | NC | Non-Connection | | |
| 25 | Vss | Ground | | |
| 26 | NC | Non-Connection | | |
| 27 | NC | Non-Connection | | |
| 28 | Vss | Ground | | |
| 29 | NC | Non-Connection | | |
| 30 | NC | Non-Connection | | |
| 31 | LED_GND | Ground_LED | | |
| 32 | LED_GND | Ground_LED | | |
| 33 | LED_GND | Ground_LED | | |
| 34 | Reserve | Non-Connection use by CMO | | |
| 35 | LED_PWM | System PWM Signal Input | | |
| 36 | LED_EN | LED enable pin | | |
| 37 | Reserve | Non-Connection use by CMO | | |
| 38 | LED_VCCS | LED Power | | |
| 39 | LED_VCCS | LED Power | | |
| 40 | LED_VCCS | LED Power | | |

Note (1) Connector Part No. I-PEX 20455-040E-12

Note (2) User's connector Part No: I-PEX 20453-040T or equivalent

Note (3) The first pixel is odd as shown in the following figure.

5.2 TIMING DIAGRAM OF LVDS INPUT SIGNAL





5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

| Color | | Data Signal | | | | | | | | | | | | | | | | | |
|---------------------|---------------|-------------|----|----|----|----|----|-------|----|----|----|----|----|------|----|----|----|----|----|
| | | Red | | | | | | Green | | | | | | Blue | | | | | |
| | | R5 | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Colors | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Scale Of Red | Red(0)/Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(1) | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(2) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Red(61) | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(62) | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(63) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Green | Green(0)/Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green(61) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(62) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(63) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Blue | Blue(0)/Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Blue(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue(61) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 |
| | Blue(62) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue(63) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |

Note (1) 0: Low Level Voltage, 1: High Level Voltage

5.4 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPD1 standards.

| Byte # (decimal) | Byte # (hex) | Field Name and Comments | Value (hex) | Value (binary) |
|------------------|--------------|--|-------------|----------------|
| 0 | 0 | Header | 00 | 00000000 |
| 1 | 1 | Header | FF | 11111111 |
| 2 | 2 | Header | FF | 11111111 |
| 3 | 3 | Header | FF | 11111111 |
| 4 | 4 | Header | FF | 11111111 |
| 5 | 5 | Header | FF | 11111111 |
| 6 | 6 | Header | FF | 11111111 |
| 7 | 7 | Header | 00 | 00000000 |
| 8 | 8 | ID system manufacturer name (LSB) | 30 | 00110000 |
| 9 | 9 | ID system manufacturer name (MSB) | AE | 10101110 |
| 10 | 0A | ID system Product Code (LSB) | B0 | 10110000 |
| 11 | 0B | ID system Product Code (MSB) | 40 | 01000000 |
| 12 | 0C | ID Serial Number (32-bit serial number) | 00 | 00000000 |
| 13 | 0D | ID Serial Number (32-bit serial number) | 00 | 00000000 |
| 14 | 0E | ID Serial Number (32-bit serial number) | 00 | 00000000 |
| 15 | 0F | ID Serial Number (32-bit serial number) | 00 | 00000000 |
| 16 | 10 | Week of Manufacture | 0A | 00001010 |
| 17 | 11 | Year of Manufacture | 13 | 00010011 |
| 18 | 12 | EDID Structure version | 01 | 00000001 |
| 19 | 13 | EDID Revision | 03 | 00000011 |
| 20 | 14 | Video Input Definition | 80 | 10000000 |
| 21 | 15 | Active Area Horizontal Image Size (cm) - 35 cm | 23 | 00100011 |
| 22 | 16 | Active Area Vertical Image Size (cm) - 19cm | 13 | 00010011 |
| 23 | 17 | Display gamma (gamma x 100)-100, (Gamma 2.2) | 78 | 01111000 |
| 24 | 18 | Feature support | EA | 11101010 |
| 25 | 19 | Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0 | 7B | 01111011 |
| 26 | 1A | Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0 | 95 | 10010101 |
| 27 | 1B | Rx=0.61 | 9C | 10011100 |
| 28 | 1C | Ry=0.343 | 57 | 01010111 |
| 29 | 1D | Gx=0.342 | 57 | 01010111 |
| 30 | 1E | Gy=0.581 | 94 | 10010100 |
| 31 | 1F | Bx=0.162 | 29 | 00101001 |
| 32 | 20 | By=0.083 | 15 | 00010101 |
| 33 | 21 | Wx=0.313 | 50 | 01010000 |
| 34 | 22 | Wy=0.329 | 54 | 01010100 |
| 35 | 23 | Established Timing 1 | 00 | 00000000 |
| 36 | 24 | Established Timing 2 | 00 | 00000000 |
| 37 | 25 | Manufacturer's Timings | 00 | 00000000 |
| 38 | 26 | Standard Timing Identification #1 | 01 | 00000001 |



Doc No.: 400035521
 Issued Date: Sep. 10, 2009
 Model No.: N156B6-L08

Approval

| | | | | |
|----|----|---|----|----------|
| 39 | 27 | Standard Timing Identification #1 | 01 | 00000001 |
| 40 | 28 | Standard Timing Identification #2 | 01 | 00000001 |
| 41 | 29 | Standard Timing Identification #2 | 01 | 00000001 |
| 42 | 2A | Standard Timing Identification #3 | 01 | 00000001 |
| 43 | 2B | Standard Timing Identification #3 | 01 | 00000001 |
| 44 | 2C | Standard Timing Identification #4 | 01 | 00000001 |
| 45 | 2D | Standard Timing Identification #4 | 01 | 00000001 |
| 46 | 2E | Standard Timing Identification #5 | 01 | 00000001 |
| 47 | 2F | Standard Timing Identification #5 | 01 | 00000001 |
| 48 | 30 | Standard Timing Identification #6 | 01 | 00000001 |
| 49 | 31 | Standard Timing Identification #6 | 01 | 00000001 |
| 50 | 32 | Standard Timing Identification #7 | 01 | 00000001 |
| 51 | 33 | Standard Timing Identification #7 | 01 | 00000001 |
| 52 | 34 | Standard Timing Identification #8 | 01 | 00000001 |
| 53 | 35 | Standard Timing Identification #8 | 01 | 00000001 |
| 54 | 36 | Detailed timing description # 1 Pixel clock ("71.93MHz", According to VESA CVT Rev1.1) | 19 | 00011001 |
| 55 | 37 | # 1 Pixel clock (hex LSB first) | 1C | 00011100 |
| 56 | 38 | # 1 H active ("1366") | 56 | 01010110 |
| 57 | 39 | # 1 H blank ("142") | 8E | 10001110 |
| 58 | 3A | # 1 H active : H blank ("1366 :142") | 50 | 01010000 |
| 59 | 3B | # 1 V active ("768") | 00 | 00000000 |
| 60 | 3C | # 1 V blank ("27") | 1B | 00011011 |
| 61 | 3D | # 1 V active : V blank ("768 :27") | 30 | 00110000 |
| 62 | 3E | # 1 H sync offset ("23") | 17 | 00010111 |
| 63 | 3F | # 1 H sync pulse width ("48") | 30 | 00110000 |
| 64 | 40 | # 1 V sync offset : V sync pulse width ("3:9") | 39 | 00111001 |
| 65 | 41 | # 1 H sync offset : H sync pulse width : V sync offset : V sync width ("23 : 48 : 3 : 9") | 00 | 00000000 |
| 66 | 42 | # 1 H image size ("344 mm") | 58 | 01011000 |
| 67 | 43 | # 1 V image size ("193 mm") | C1 | 11000001 |
| 68 | 44 | # 1 H image size : V image size ("344 : 193") | 10 | 00010000 |
| 69 | 45 | # 1 H boarder ("0") | 00 | 00000000 |
| 70 | 46 | # 1 V boarder ("0") | 00 | 00000000 |
| 71 | 47 | # 1 Non-interlaced, Normal, no stereo, Separate sync, H/V pol Negatives | 18 | 00011000 |
| 72 | 48 | Detailed timing description # 2 Pixel clock ("58.49MHz", According to VESA CVT Rev1.1) | D9 | 11011001 |
| 73 | 49 | #2 Pixel clock (hex LSB first) | 16 | 00010110 |
| 74 | 4A | #2 H active ("1366") | 56 | 01010110 |
| 75 | 4B | # 2 H blank ("128") | 80 | 10000000 |
| 76 | 4C | # 2 H active : H blank ("1366 : 128") | 50 | 01010000 |
| 77 | 4D | # 2 V active ("768") | 00 | 00000000 |
| 78 | 4E | # 2 V blank ("15") | 0F | 00001111 |
| 79 | 4F | # 2 V active : V blank ("768:15") | 30 | 00110000 |
| 80 | 50 | # 2 H sync offset ("38") | 26 | 00100110 |
| 81 | 51 | # 2 H sync pulse width ("26") | 1A | 00011010 |
| 82 | 52 | # 2 V sync offset : V sync pulse width ("2 : 4") | 24 | 00100100 |
| 83 | 53 | # 2 H sync offset : H sync pulse width : V sync offset : V sync width ("38: 26 : 2 : 4") | 00 | 00000000 |



Doc No.: 400035521
 Issued Date: Sep. 10, 2009
 Model No.: N156B6-L08

Approval

| | | | | |
|-----|----|---|----|----------|
| 84 | 54 | # 2H image size ("344 mm") | 58 | 01011000 |
| 85 | 55 | # 2V image size ("193 mm") | C1 | 11000001 |
| 86 | 56 | # 2 H image size : V image size ("344 : 193") | 10 | 00010000 |
| 87 | 57 | # 2 H boarder ("0") | 00 | 00000000 |
| 88 | 58 | # 2 V boarder ("0") | 00 | 00000000 |
| | | # 2 Non-interlaced ; Normal display, no stereo ; Digital Separate ; V sync POL is negative ; H sync POL is positive | 18 | 00011000 |
| 89 | 59 | | | |
| 90 | 5A | Flag | 00 | 00000000 |
| 91 | 5B | Flag | 00 | 00000000 |
| 92 | 5C | Flag | 00 | 00000000 |
| 93 | 5D | Data Type Tag | 0F | 00001111 |
| 94 | 5E | Flag | 00 | 00000000 |
| 95 | 5F | Middle Refresh Rate #1 (Horizontal active pixels / 8) - 31 | 8C | 10001100 |
| 96 | 60 | Middle Refresh Rate #1 Image Aspect ratio (16 : 9) | 09 | 00001001 |
| 97 | 61 | Middle Refresh Rate #1 Refresh Rate = 50Hz | 32 | 00110010 |
| 98 | 62 | Low Refresh Rate #2 (Horizontal active pixels / 8) - 31 | 8C | 10001100 |
| 99 | 63 | Low Refresh Rate #2 Image Aspect ratio(16 : 9) | 09 | 00001001 |
| 100 | 64 | Low Refresh Rate #2 Refresh Rate=40Hz | 28 | 00101000 |
| 101 | 65 | Brightness(220 /10 nit) | 16 | 00010110 |
| 102 | 66 | Feature flag | 09 | 00001001 |
| 103 | 67 | Reserved | 00 | 00000000 |
| 104 | 68 | LCD Supplier manufacturer code | 0D | 00001101 |
| 105 | 69 | LCD Supplier manufacturer code, (Hex, LSB first) | AF | 10101111 |
| 106 | 6A | LCD Supplier Product code | 50 | 01010000 |
| 107 | 6B | LCD Supplier Product code (Hex, LSB first) | 14 | 00010100 |
| 108 | 6C | Flag | 00 | 00000000 |
| 109 | 6D | Flag | 00 | 00000000 |
| 110 | 6E | Flag | 00 | 00000000 |
| 111 | 6F | Data Type Tag | FE | 11111110 |
| 112 | 70 | Flag | 00 | 00000000 |
| 113 | 71 | Model Name (N156B6-L08, 1st character, "N") | 4E | 01001110 |
| 114 | 72 | Model Name (N156B6-L08, 2nd character, "1") | 31 | 00110001 |
| 115 | 73 | Model Name (N156B6-L08, 3rd character, "5") | 35 | 00110101 |
| 116 | 74 | Model Name (N156B6-L08, 4th character, "6") | 36 | 00110110 |
| 117 | 75 | Model Name (N156B6-L08, 5th character, "B") | 42 | 01000010 |
| 118 | 76 | Model Name (N156B6-L08, 6th character, "6") | 36 | 00110110 |
| 119 | 77 | Model Name (N156B6-L08, 7th character, "-") | 2D | 00101101 |
| 120 | 78 | Model Name (N156B6-L08, 8th character, "L") | 4C | 01001100 |
| 121 | 79 | Model Name (N156B6-L08, 9th character, "0") | 30 | 00110000 |
| 122 | 7A | Model Name (N156B6-L08, 10th character, "8") | 38 | 00111000 |
| 123 | 7B | Model Name(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h) | 0A | 00001010 |
| 124 | 7C | Model Name (If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h) | 20 | 00100000 |
| 125 | 7D | Model Name (If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h) | 20 | 00100000 |
| 126 | 7E | Extension flag | 00 | 00000000 |
| 127 | 7F | Checksum | 54 | 01010100 |

6. CONVERTER

6.1 ABSOLUTE MAXIMUM RATINGS

| Symbol | Ratings |
|-----------------|------------|
| LED_VCCS | -0.3~25V |
| LED_PWM, LED_EN | -0.3V~5.0V |

6.2 RECOMMENDED OPERATING RATINGS

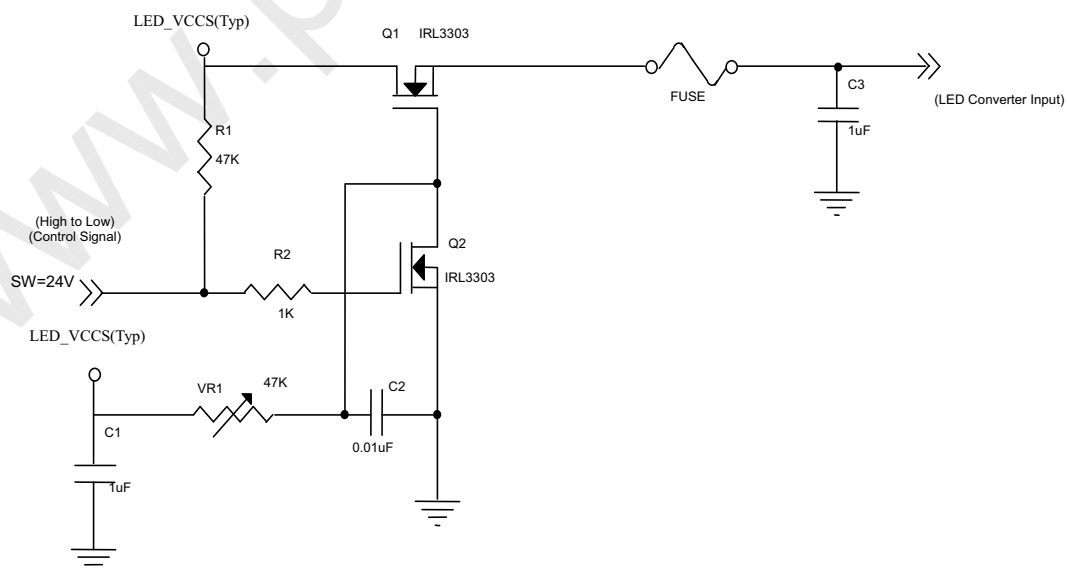
| Parameter | | Symbol | Value | | | Unit | Note |
|--|----------------|-----------------------|-------|------|------|------|------|
| | | | Min. | Typ. | Max. | | |
| Converter Input power supply voltage | | LED_Vccs | 6.0 | 12.0 | 21.0 | V | |
| Converter Rush Current | | I _{LED_RUSH} | - | - | 1.5 | A | (2) |
| Converter Initial Stage Current | | I _{LED_IS} | - | - | 1.5 | A | (2) |
| EN Control Level | Backlight On | | 2.0 | --- | 5.0 | V | |
| | Backlight Off | | 0 | --- | 0.8 | V | |
| PWM Control Level | PWM High Level | | 2 | --- | 5.0 | V | |
| | PWM Low Level | | 0 | --- | 0.15 | V | |
| PWM Control Duty Ratio | | | 1 | | 100 | % | |
| PWM Control Permissible Ripple Voltage | | V _{PWM_pp} | | | 100 | mV | |
| PWM Control Frequency | | f _{PWM} | 100 | 210 | 1000 | Hz | |
| Converter Input Current | LED_VCCS=Min | I _{BL} | 507 | 602 | 714 | mA | (1) |
| | LED_VCCS=Typ | | 253 | 301 | 357 | mA | (1) |
| | LED_VCCS=Max | | 145 | 172 | 204 | mA | (1) |

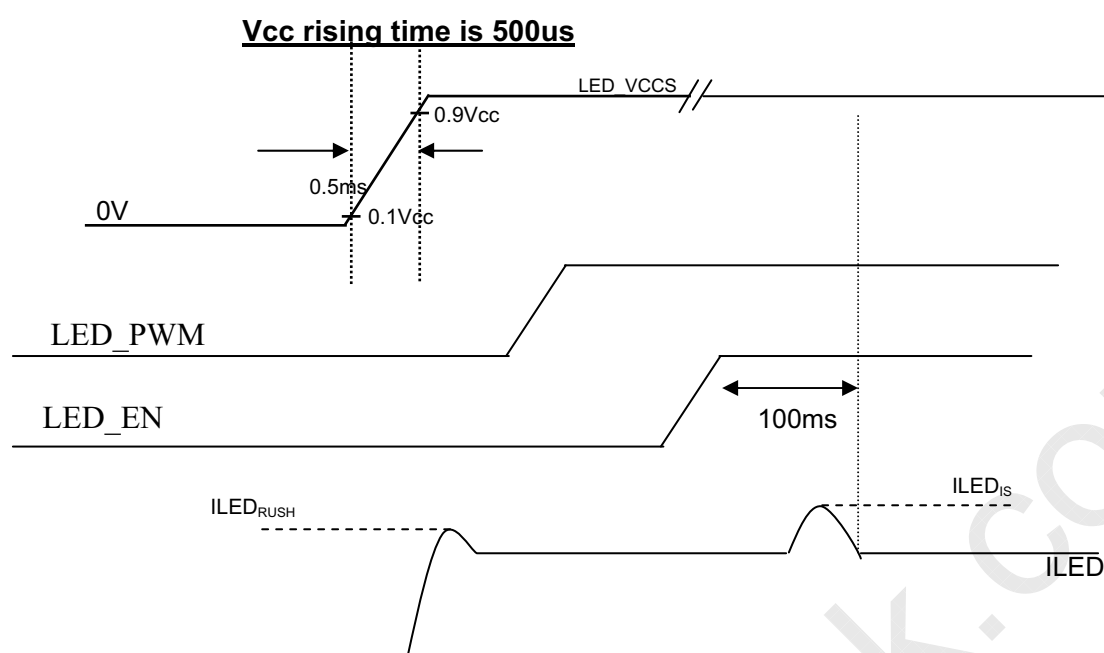
Note (1) The specified LED power supply current is under the conditions at “LED_VCCS = Min, Typ, Max”,
 $T_a = 25 \pm 2^\circ\text{C}$, $f_{\text{PWM}} = 200\text{ Hz}$, Duty=100%.

Note (2) I_{LED_RUSH}: the maximum current when LED_VCCS is rising,

I_{LED_IS}: the maximum current of the first 100ms after power-on,

Measurement Conditions: Shown as the following figure. LED_VCCS = Typ, $T_a = 25 \pm 2^\circ\text{C}$, $f_{\text{PWM}} = 200\text{ Hz}$, Duty=100%.







7. INTERFACE TIMING

7.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

Refresh rate 60Hz

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|--------|-----------------------------------|--------|--------|------|--------|------|------|
| DCLK | Frequency | 1/Tc | 67.9 | 75.5 | 80 | MHz | (2) |
| DE | Vertical Total Time | TV | 778 | 806 | 888 | TH | - |
| | Vertical Active Display Period | TVD | 768 | 768 | 768 | TH | - |
| | Vertical Active Blanking Period | TVB | TV-TVD | 38 | TV-TVD | TH | |
| | Horizontal Total Time | TH | 1446 | 1560 | 1950 | Tc | (2) |
| | Horizontal Active Display Period | THD | 1366 | 1366 | 1366 | Tc | (2) |
| | Horizontal Active Blanking Period | THB | TH-THD | 194 | TH-THD | Tc | (2) |

Refresh rate 50Hz

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|--------|-----------------------------------|--------|--------|-------|--------|------|------|
| DCLK | Frequency | 1/Tc | 52.64 | 58.49 | 65.43 | MHz | (2) |
| DE | Vertical Total Time | TV | 778 | 783 | 862 | TH | - |
| | Vertical Active Display Period | TVD | 768 | 768 | 768 | TH | - |
| | Vertical Active Blanking Period | TVB | TV-TVD | 15 | TV-TVD | TH | |
| | Horizontal Total Time | TH | 1446 | 1494 | 1867 | Tc | (2) |
| | Horizontal Active Display Period | THD | 1366 | 1366 | 1366 | Tc | (2) |
| | Horizontal Active Blanking Period | THB | TH-THD | 128 | TH-THD | Tc | (2) |

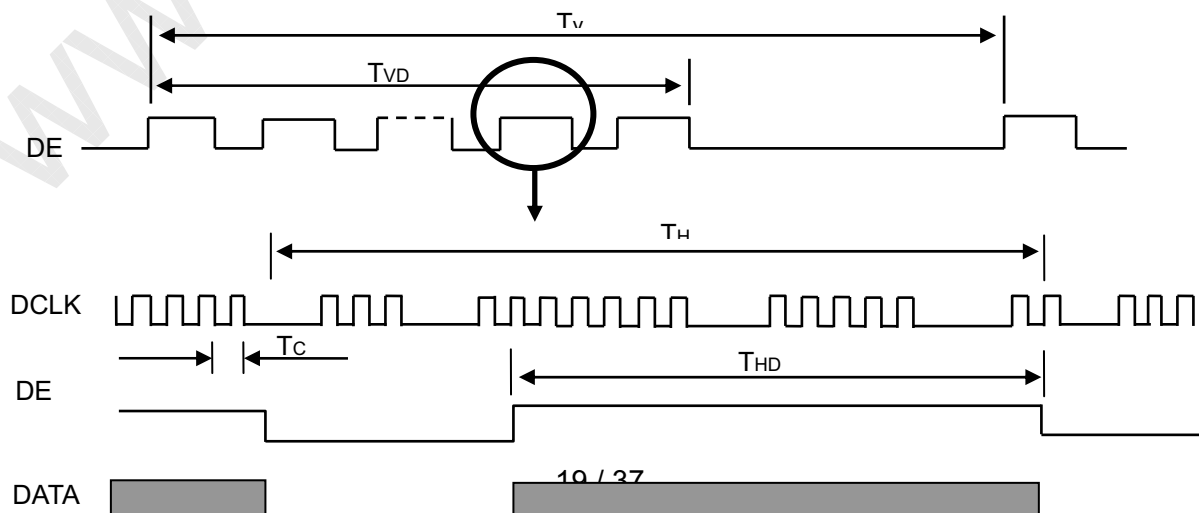
Refresh rate 40Hz

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|--------|-----------------------------------|--------|--------|------|--------|------|------|
| DCLK | Frequency | 1/Tc | 42.12 | 46.8 | 51.48 | MHz | (2) |
| DE | Vertical Total Time | TV | 778 | 783 | 862 | TH | - |
| | Vertical Active Display Period | TVD | 768 | 768 | 768 | TH | - |
| | Vertical Active Blanking Period | TVB | TV-TVD | 15 | TV-TVD | TH | |
| | Horizontal Total Time | TH | 1446 | 1494 | 1867 | Tc | (2) |
| | Horizontal Active Display Period | THD | 1366 | 1366 | 1366 | Tc | (2) |
| | Horizontal Active Blanking Period | THB | TH-THD | 128 | TH-THD | Tc | (2) |

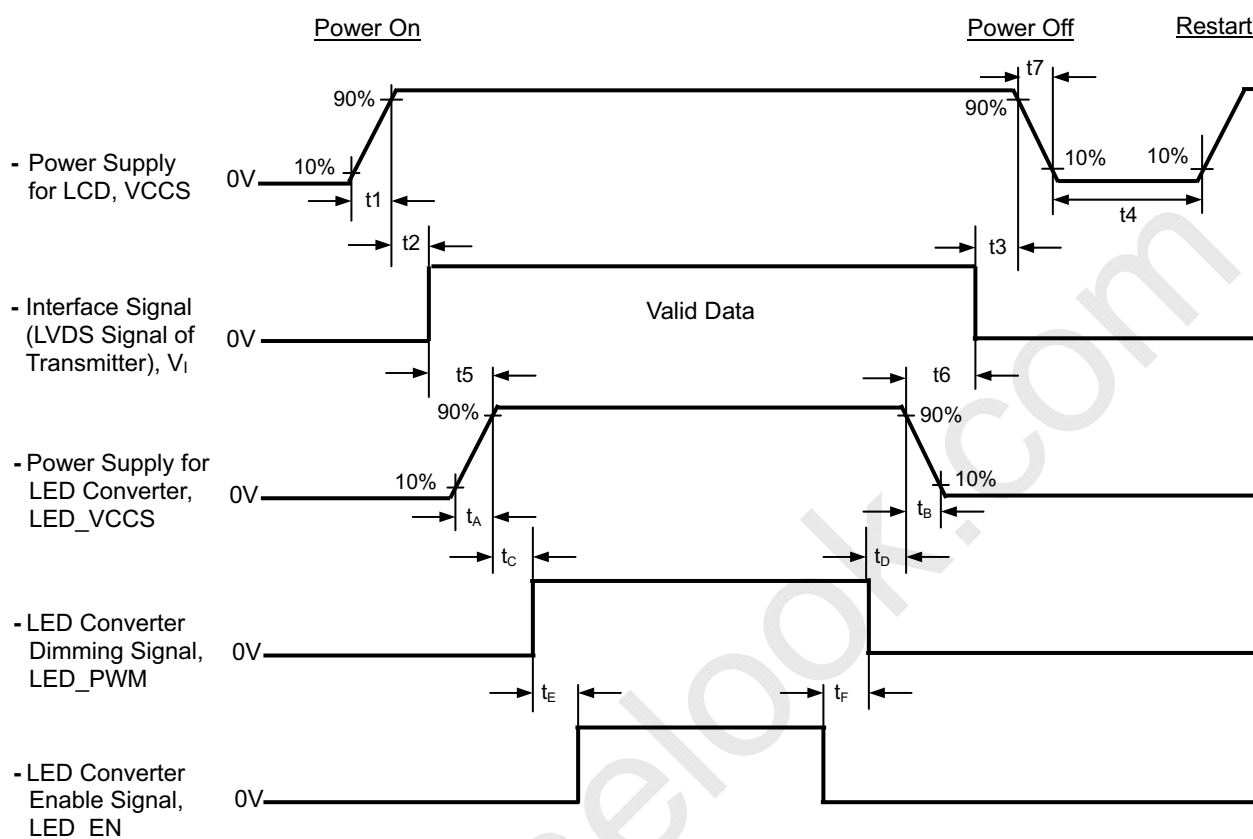
Note (1) Because this module is operated by DE only mode, Hsync and Vsync are ignored.

(2) 2 channels LVDS input.

INPUT SIGNAL TIMING DIAGRAM



7.2 POWER ON/OFF SEQUENCE



Timing Specifications:

$$0.5 \leq t_1 \leq 10 \text{ ms}$$

$$0 \leq t_2 \leq 50 \text{ ms}$$

$$0 \leq t_3$$

$$t_4 \geq 150 \text{ ms}$$

$$t_5 \geq 200 \text{ ms}$$

$$t_6 \geq 0 \text{ ms}$$

$$0 \leq t_7 \leq 10 \text{ ms}$$

$$t_C \geq 0 \text{ ms}$$

$$t_D \geq 0 \text{ ms}$$

$$t_E \geq 0 \text{ ms}$$

$$t_F \geq 0 \text{ ms}$$



Doc No.: 400035521
Issued Date: Sep. 10, 2009
Model No.: N156B6-L08

Approval

Note (1) Please follow the power on/off sequence described above. Otherwise, the LCD module might be damaged.

Note (2) Please avoid floating state of interface signal at invalid period. When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

Note (3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Please follow the LED converter power sequence as above. If the customer could not follow, it might cause backlight flash issue during display ON/OFF or damage the LED backlight controller

8. OPTICAL CHARACTERISTICS

8.1 TEST CONDITIONS

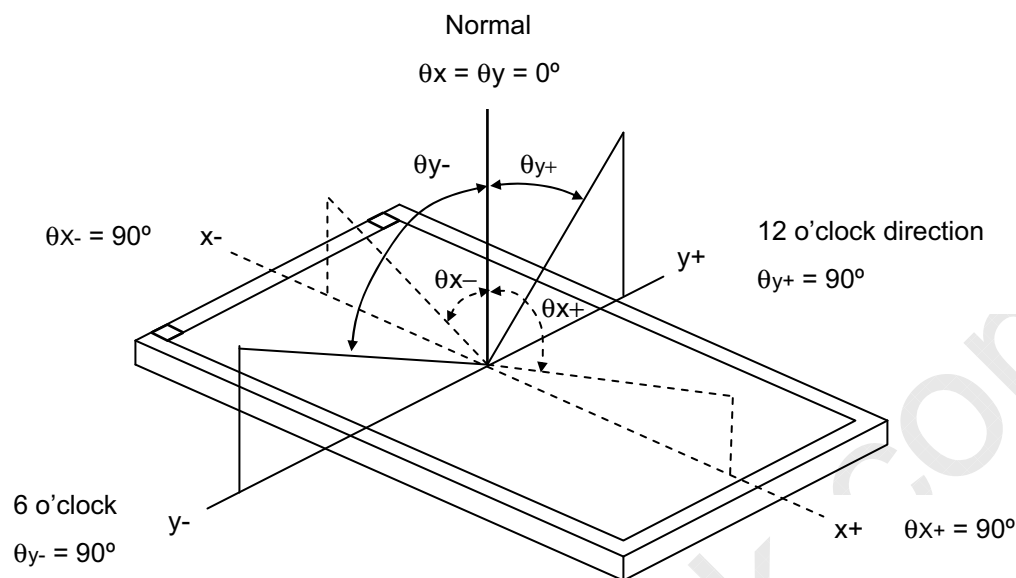
| Item | Symbol | Value | Unit |
|---------------------|---|-------|------|
| Ambient Temperature | Ta | 25±2 | °C |
| Ambient Humidity | Ha | 50±10 | %RH |
| Supply Voltage | V _{CC} | 3.3 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| Converter Current | I _L | 120 | mA |

The measurement methods of optical characteristics are shown in Section 8.2. The following items should be measured under the test conditions described in Section 8.1 and stable environment shown in Note (5).

8.2 OPTICAL SPECIFICATIONS

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|------------------------------|------------|-------------------|--|---------------|-------|---------------|-------------------|----------|
| Contrast Ratio | | CR | $\theta_x=0^\circ, \theta_Y=0^\circ$ Viewing Normal Angle | 500 | 650 | - | - | (2), (5) |
| Response Time | | T _R | | - | 3 | 5 | ms | (3) |
| | | T _F | | - | 5 | 11 | ms | |
| Average Luminance of White | | L _{Ave} | | 190 | 220 | - | cd/m ² | (4), (6) |
| Color Chromaticity | Red | R _x | | TYP. -0.03 | 0.623 | TYP. +0.03 | - | (1) |
| | | R _y | | | 0.345 | | - | |
| | Green | G _x | | | 0.340 | | - | |
| | | G _y | | | 0.592 | | - | |
| | Blue | B _x | | | 0.159 | | - | |
| | | B _y | | | 0.074 | | - | |
| | White | W _x | | | 0.313 | | - | |
| | | W _y | | | 0.329 | | - | |
| Viewing Angle | Horizontal | θ_x+ | CR≥10 | 40 | 45 | - | Deg. | (1),(5) |
| | | θ_x- | | 40 | 45 | - | | |
| | Vertical | θ_Y+ | | 15 | 20 | - | | |
| | | θ_Y- | | 40 | 45 | - | | |
| White Variation of 5 Points | | ΔW _{5p} | $\theta_x=0^\circ, \theta_Y=0^\circ$ | 75 | | | % | (5),(6) |
| White Variation of 13 Points | | ΔW _{13p} | $\theta_x=0^\circ, \theta_Y=0^\circ$ | 60 | | | % | (5),(6) |

Note (1) Definition of Viewing Angle (θ_x , θ_y):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

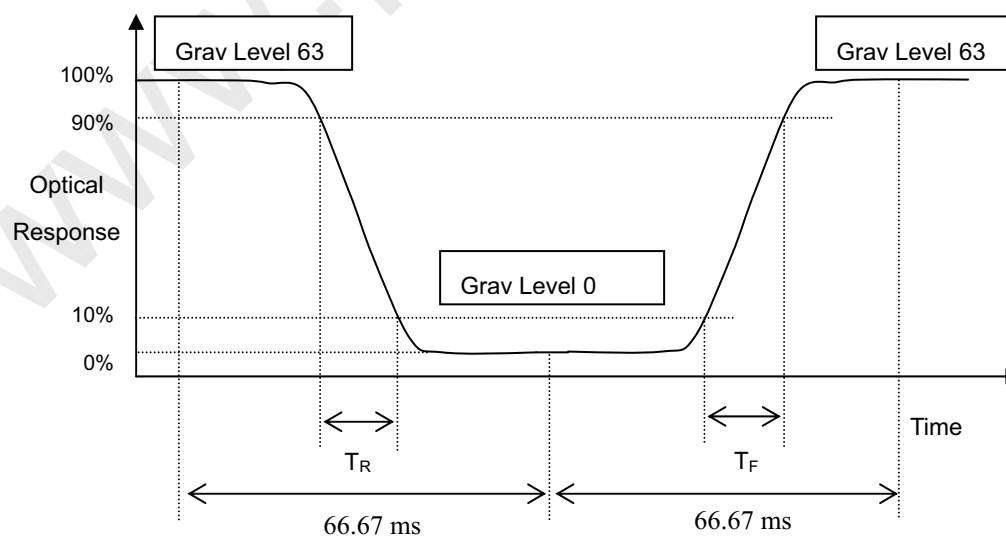
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (1)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R , T_F):



Note (4) Definition of Average Luminance of White (L_{AVE}):

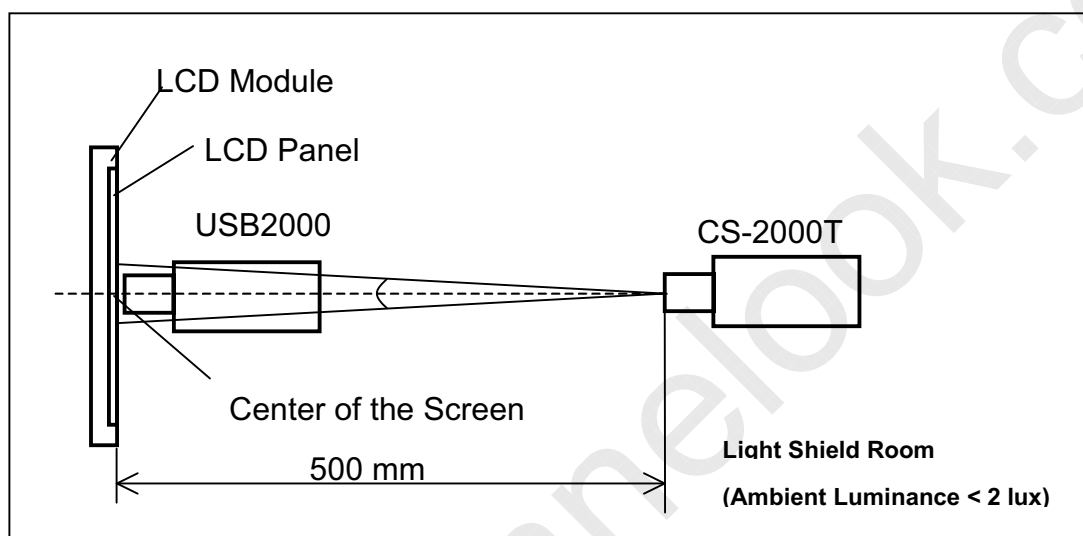
Measure the luminance of gray level 63 at 5 points

$$L_{AVE} = [L(1) + L(2) + L(3) + L(4) + L(5)] / 5$$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (6)

Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (6) Definition of White Variation (δW):

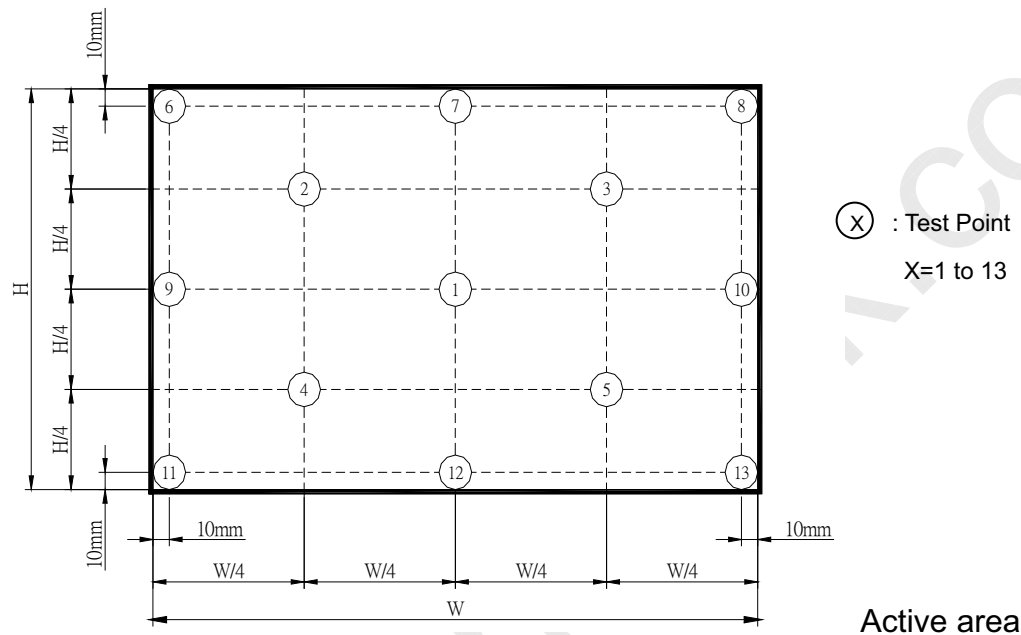
Measure the luminance of gray level 63 at 5 points

$$\delta W_{5p} = \text{Minimum} [L(1) + L(2) + L(3) + L(4) + L(5)] / \text{Maximum} [L(1) + L(2) + L(3) + L(4) + L(5)]$$

Note (7) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 13 points

$$\delta W_{13p} = \text{Minimum} [L(1) + L(2) + L(3) + L(4) + L(5) + L(6) + L(7) + L(8) + L(9) + L(10) + L(11) + L(12) + L(13)] / \text{Maximum} [L(1) + L(2) + L(3) + L(4) + L(5) + L(6) + L(7) + L(8) + L(9) + L(10) + L(11) + L(12) + L(13)]$$



9. PRECAUTIONS

9.1 HANDLING PRECAUTIONS

- (1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
- (5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (9) Do not disassemble the module.
- (10) Do not pull or fold the LED wire.
- (11) Pins of I/F connector should not be touched directly with bare hands.

9.2 STORAGE PRECAUTIONS

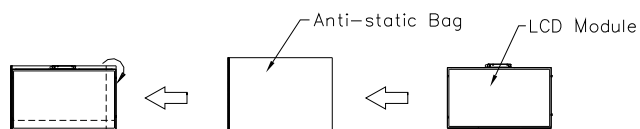
- (1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (3) It may reduce the display quality if the ambient temperature is lower than 10 °C. For example, the response time will become slowly, and the starting voltage of LED will be higher than the room temperature.

9.3 OPERATION PRECAUTIONS

- (1) Do not pull the I/F connector in or out while the module is operating.
- (2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.
- (3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with converter. Do not disassemble the module or insert anything into the Backlight unit.

10. PACKING

10.1 CARTON



Box Dimensions : 489(L)*382(W)*320(H)

Weight: Approx. 13.11kg(20 module .per. 1 box)

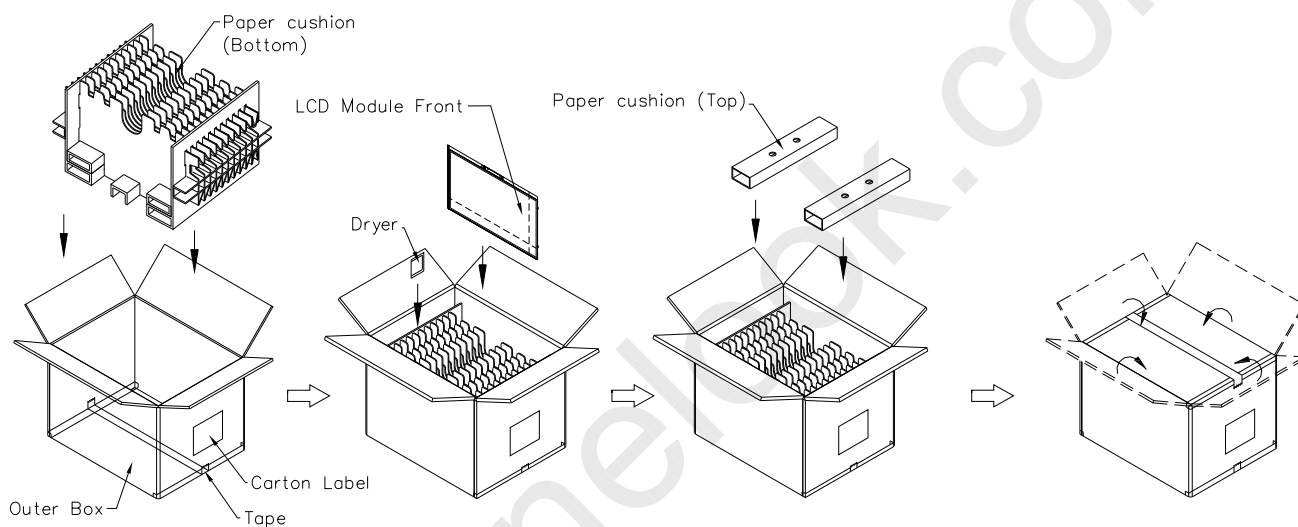


Figure. 10-1 Packing method

10.2 PALLET

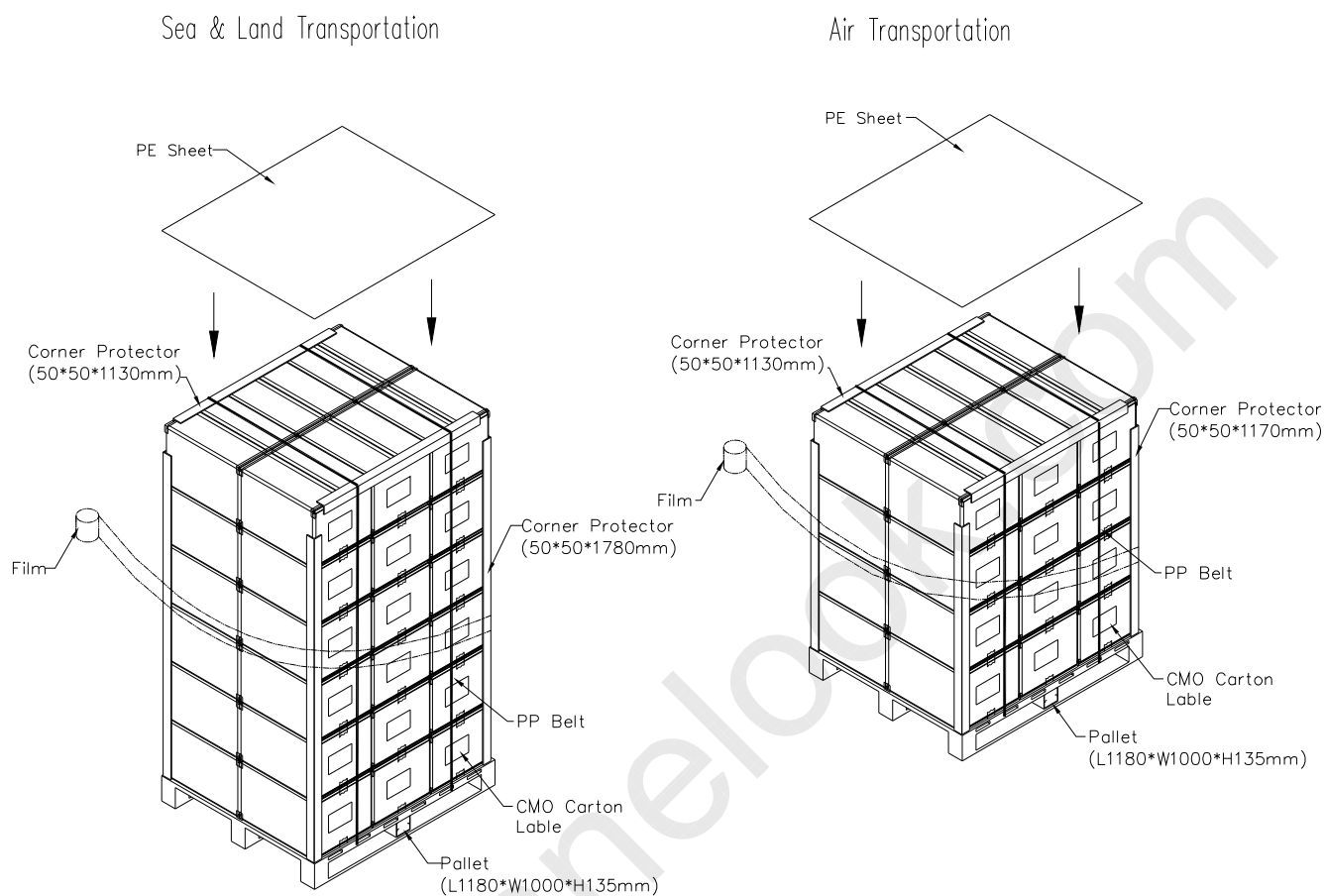


Figure. 10-2 Packing method

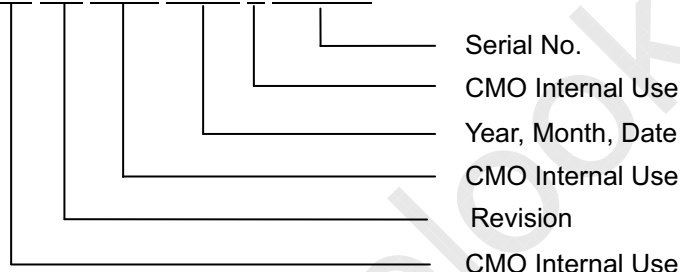
11. DEFINITION OF LABELS

11.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



- (a) Model Name: N156B6-L08
- (b) Revision: Rev. XX, for example: A1, ..., C1, C2 ...etc.
- (c) Serial ID: X X X X X X Y M D X N N N N



- (d) Production Location: MADE IN XXXX. XXXX stands for production location.
- (e) UL/CB logo: LEOO especially stands for panel manufactured by CMO NingBo satisfying UL/CB requirement. The panel without LEOO mark stands for manufactured by CMO Taiwan satisfying UL/CB requirement.

Serial ID includes the information as below:

- (a) Manufactured Date: Year: 1~9, for 2001~2009
 Month: 1~9, A~C, for Jan. ~ Dec.
 Day: 1~9, A~Y, for 1st to 31st, exclude I, O and U
- (b) Revision Code: cover all the change
- (c) Serial No.: Manufacturing sequence of product

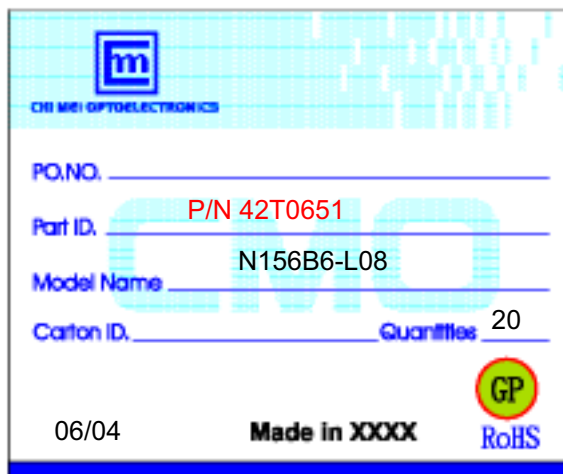
For Lenovo's barcode content

11S PPPPPP Z1Z HHH SSSSSS YMM (11S42T0651Z1ZFKYSSSSSS 601)

- (a) 11S: Fixed characters.
- (b) PPPPPP (P/N): Customer part number, fixed characters (N156B6-L08 current is 42T0651)
- (c) Z1Z: Fixed characters.
- (d) HHH (Header Code): FKY
- (e) SSSSSS: Series number.
- (f) YMM: Y: The last character of year. MM: Month



11.2 CMO CARTON LABEL




CHI MEI OPTOELECTRONICS

PO/NO. _____

Part ID. **P/N 42T0651**

Model Name **N156B6-L08**

Carton ID. _____ Quantities **20**

06/04 **Made in XXXX** 

(a) Production location: Made In XXXX. XXXX stands for production location.

12 Inspection Standards for LCD Modules

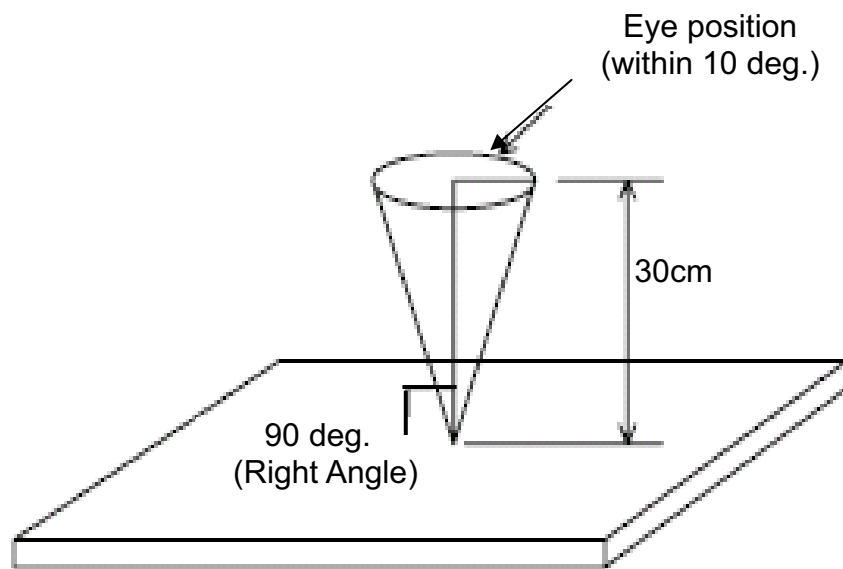
12.1 Description

These inspection standards shall be applied to LCD Module supplied by CHI MEI Optoelectronics Corporation.

12.2 The environmental condition of inspection

The environmental condition and visual inspection shall be conducted as below.

- (1) Ambient temperature : 15~25 °C
- (2) Humidity: 25~75 %RH
- (3) External appearance inspection shall be conducted by using a single 20W fluorescent lamp or equivalent illumination.
- (4) Panel visual inspection on the operation condition for cosmetic shall be conducted at the distance 30cm between the LCD module and eyes of inspector



12.3 Classification of defects

Defects are classified two types, major defect and minor defect according to the defect.

And, the definition of defects is classified as below.

(1) Major defect

Any defect may result in functional failure, or reduce the usability of product for its purpose. For example, electrical failure, deformation and etc..

(2) Minor defect

A defect that is not to reduce the usability of product for its intended purpose and un-uniformity, dot defect and etc..

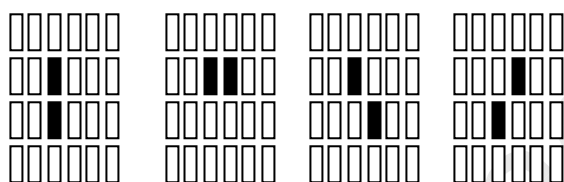
The criteria on major and/or minor judgement will be according with the classification of defects.

12.4 Inspection Criteria

(1) Definition of dot defect

Define spec for 2 dot adjacent and minimum distance

2-adjacent(Linked Pixels)



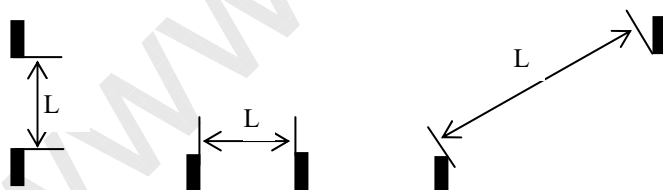
□ : sub-Pixel(R,G,B)

Minimum Distance;

Lit to Lit : $L \geq 15\text{mm}$

Unlit to Unlit : $L \geq 5\text{mm}$

Lit to Unlit : Not Applicable



L: Sub-Pixel to Sub-Pixel, Sub-Pixel to 2-adjacent or 2-adjacent to 2-adjacent

(2) Display Inspection

(a) Ambient Luminance: 250 Lux or more for light on inspection

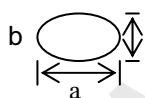
(b) Viewing Angle: Within LCD Viewing Angle Specification

(c) Inspection Pattern : In Black, White, Red, Green, Blue and 32-Gray(Half-Gray) Screens

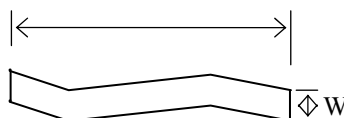
| Items | | Acceptable count |
|---|--|------------------------------|
| Bright dot | Random | $N \leq 2$ (Green ≤ 1) |
| | 2 dots adjacent | $N \leq 0$ |
| | 3 dots adjacent or more | $N \leq 0$ |
| Dark dot | Random | $N \leq 3$ |
| | 2 dots adjacent | $N \leq 1$ |
| | 3 dots adjacent or more | $N \leq 0$ |
| Distance | Minimum Distance Between Bright dots | $L \geq 15\text{mm}$ |
| | Minimum Distance Between Dark dots | $L \geq 5\text{mm}$ |
| | Lit to Unlit | Not Applicable |
| Total bright and dark dot | | $N \leq 5$ |
| Dot(Lit/Unlit) : Noticeable defective dots in the office environment (250 lux) will be counted regardless of defective dot size | | |
| Display failure (V-line/H-line/Cross line etc.) | | Not allowable |
| Mura | Not visible through 8% ND filter or judge by limit sample if necessary | |

- (3) Appearance inspection
- (a) Ambient Illumination : 500~700 Lux
- (b) View angle: Backlight-Off Condition : At Right Angle To Polarizer Surface
Backlight-On Condition Within LCD Viewing Angle Specification
- (c) Inspection Pattern: In white and 32-Gray (Half-Gray) Screens(Backlight-On)

| Items | Size(mm) | Acceptable count |
|--|--|------------------|
| 1. Scratch(Line Shape) : B/L –off condition | $W < 0.05$ | Ignore |
| | $0.05 \leq W < 0.1; 0.3 \leq L \leq 3.0$ | $N \leq 4$ |
| | $0.10 \leq W$ or $3.0 < L$ | $N = 0$ |
| | Shall be no visible at backlight-on | |
| 2. Dent : B/L –on/off condition | $D < 0.2$ | Ignore |
| | $0.2 \leq D < 0.5$ | $N \leq 5$ |
| | $0.5 \leq D$ | $N = 0$ |
| | Spacing between defects shall be more than 30 mm. ($0.2 \leq D < 0.5$) Shall be no visible at B/L on. | |
| 3. Bubble : B/L –off condition | $D < 0.2$ | Ignore |
| | $0.2 \leq D < 0.5$ | $N \leq 5$ |
| | $0.5 \leq D$ | $N = 0$ |
| | Shall be no visible at B/L on. | |
| 4. Foreign material (Line-shape:stain inclusion) :B/L-on condition | $W < 0.05$ | Ignore |
| | $0.05 \leq W < 0.1; 0.3 \leq L \leq 2.0$ | $N \leq 4$ |
| | $0.1 < W$ or $2.0 < L$ | $N = 0$ |
| 5. Foreign material (Dot-shape:stain inclusion) :B/L-on condition | $D < 0.2$ | Ignore |
| | $0.2 \leq D < 0.5$ | $N \leq 5$ |
| | $0.5 \leq D$ | $N = 0$ |
| 6. Peeling on Polizer edge :B/L-off condition | $D < 0.2$ | Ignore |
| | $0.2 \leq D < 0.5$ | $N \leq 5$ |
| | $0.5 \leq D$ | $N = 0$ |
| | Bubble or glue shall not be visible within PC bezel opening area with specified inspection viewing angle. | |
| | Continuous peeling off on polarizer edge shall be discussed. Shall be no visible at backlight-on | |



$$D = (a+b)/2$$



W: width, L : length



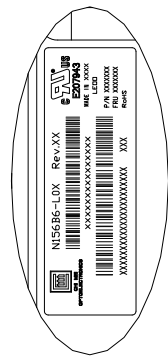
12.5 External Appearance Inspection Criteria

| Item | Contents | |
|------------------------|--|---|
| Screw | Parts mounting, incomplete assembly, deformation, oxidized, crooked or rusty is not permitted. | |
| CCFT cable | Cable not continuous 、 Break-off 、 Connector Burn-off /Break-off | |
| Metal frame (Bezel) | Scratch | *Noticeable scratch and exfoliation coating are not permitted. *The oxidized metal is not permitted. |
| | Incomplete assembly is not permitted. | |
| Backlight | Scratch | The scratch which may causes a problem in practical use is not permitted. |
| | Break-off | Breaking off is not permitted. |
| | Crack | The crack is not permitted. |
| Stain on Polarizer | The stain which can't be wiped off is not permitted. | |
| Tape/Label | Incorrect position, missed label is not permitted. | |
| Connector | Oxidized/rusty connector is not permitted. | |
| Outline size | Spec. out is not permitted. | |

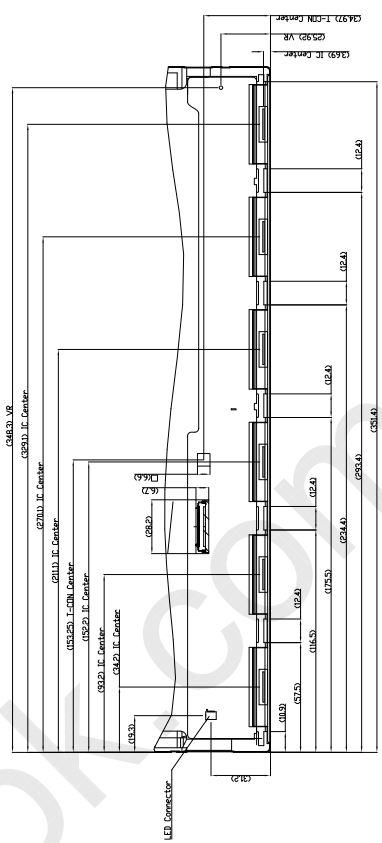
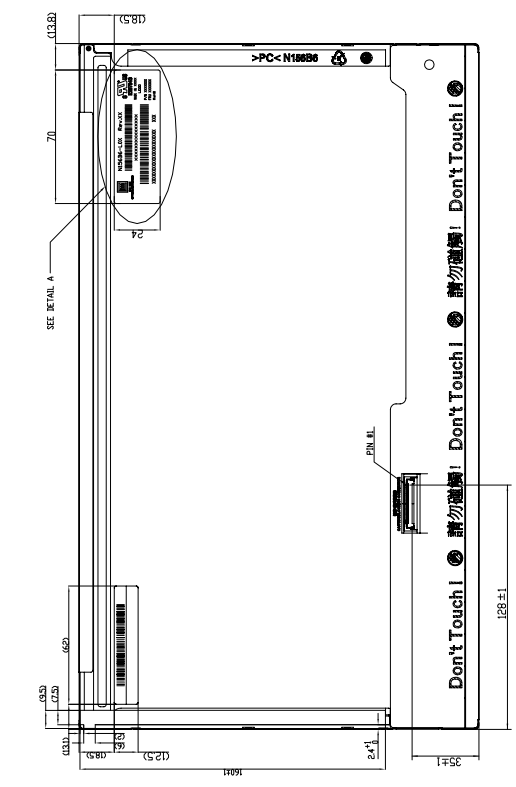
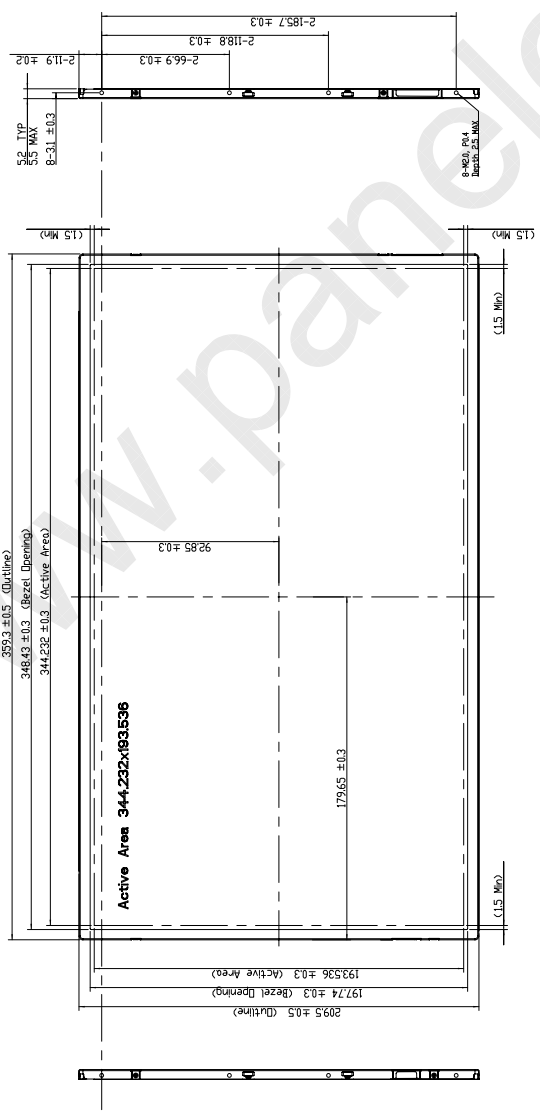


12.6 Classification of defects

| Inspection Item | Criteria and Description | Defect type |
|-------------------------------|--|-------------|
| Vertical line | Signal input, vertical line off or irregular V-line appears | major |
| Horizontal line | Signal input, horizontal line off or irregular H-line appears | major |
| Cross line | Pattern signal input, a correct display is not obtained | major |
| No display | Signal input, display is dead | major |
| Irregular display | Pattern signal input, a correct display is not obtained | major |
| Dots defect | Exceed specified standards | minor |
| Scratch and Dent on polarizer | Exceed specified standards | minor |
| Foreign material | Exceed specified standards | minor |
| Mura | Not visible through 6% ND filter or judge by limit sample | minor |
| External Appearance | Rust, deformation, irregular plating, coating missing etc. A appearance defect that do not affect function or performance | minor |
| Bezel claw | Bezel claw missing or not bent | major |
| Polarizer bubble | Exceed specified standards | minor |
| Flicker | Signal input, Flicker appears | major |



DETAIL A
SCALE 2x



ICF AND IC CENTER LOCATION
SEE NOTE '5' FOR EXPLANATION.

- NOTES:
- 1) Max screw length: 2.5mm
 - 2) Max screw torque: 2.0 kgf-cm
 - 3) LCD module input connector: 1-PEX 20455-040E-12 or equivalent.
 - 4) Gap between bezel and panel: 0.5mm MAX.
 - 5) In order to avoid abnormal display, pooling and white spot, no overlapping is suggested at cables, antennas, camera, WLAN, WAN or other foreign objects over ICF, ICN and VR locations.
 - 6) Max module flatness: 0.5mm.

| ITEM | | DESCRIPTION | REVISION |
|------|-----|-----------------|----------|
| 1 | 1 | Initial Release | 1.0 |
| 2 | 2 | Rev. 1.1 | 1.1 |
| 3 | 3 | Rev. 1.2 | 1.2 |
| 4 | 4 | Rev. 1.3 | 1.3 |
| 5 | 5 | Rev. 1.4 | 1.4 |
| 6 | 6 | Rev. 1.5 | 1.5 |
| 7 | 7 | Rev. 1.6 | 1.6 |
| 8 | 8 | Rev. 1.7 | 1.7 |
| 9 | 9 | Rev. 1.8 | 1.8 |
| 10 | 10 | Rev. 1.9 | 1.9 |
| 11 | 11 | Rev. 2.0 | 2.0 |
| 12 | 12 | Rev. 2.1 | 2.1 |
| 13 | 13 | Rev. 2.2 | 2.2 |
| 14 | 14 | Rev. 2.3 | 2.3 |
| 15 | 15 | Rev. 2.4 | 2.4 |
| 16 | 16 | Rev. 2.5 | 2.5 |
| 17 | 17 | Rev. 2.6 | 2.6 |
| 18 | 18 | Rev. 2.7 | 2.7 |
| 19 | 19 | Rev. 2.8 | 2.8 |
| 20 | 20 | Rev. 2.9 | 2.9 |
| 21 | 21 | Rev. 3.0 | 3.0 |
| 22 | 22 | Rev. 3.1 | 3.1 |
| 23 | 23 | Rev. 3.2 | 3.2 |
| 24 | 24 | Rev. 3.3 | 3.3 |
| 25 | 25 | Rev. 3.4 | 3.4 |
| 26 | 26 | Rev. 3.5 | 3.5 |
| 27 | 27 | Rev. 3.6 | 3.6 |
| 28 | 28 | Rev. 3.7 | 3.7 |
| 29 | 29 | Rev. 3.8 | 3.8 |
| 30 | 30 | Rev. 3.9 | 3.9 |
| 31 | 31 | Rev. 4.0 | 4.0 |
| 32 | 32 | Rev. 4.1 | 4.1 |
| 33 | 33 | Rev. 4.2 | 4.2 |
| 34 | 34 | Rev. 4.3 | 4.3 |
| 35 | 35 | Rev. 4.4 | 4.4 |
| 36 | 36 | Rev. 4.5 | 4.5 |
| 37 | 37 | Rev. 4.6 | 4.6 |
| 38 | 38 | Rev. 4.7 | 4.7 |
| 39 | 39 | Rev. 4.8 | 4.8 |
| 40 | 40 | Rev. 4.9 | 4.9 |
| 41 | 41 | Rev. 5.0 | 5.0 |
| 42 | 42 | Rev. 5.1 | 5.1 |
| 43 | 43 | Rev. 5.2 | 5.2 |
| 44 | 44 | Rev. 5.3 | 5.3 |
| 45 | 45 | Rev. 5.4 | 5.4 |
| 46 | 46 | Rev. 5.5 | 5.5 |
| 47 | 47 | Rev. 5.6 | 5.6 |
| 48 | 48 | Rev. 5.7 | 5.7 |
| 49 | 49 | Rev. 5.8 | 5.8 |
| 50 | 50 | Rev. 5.9 | 5.9 |
| 51 | 51 | Rev. 6.0 | 6.0 |
| 52 | 52 | Rev. 6.1 | 6.1 |
| 53 | 53 | Rev. 6.2 | 6.2 |
| 54 | 54 | Rev. 6.3 | 6.3 |
| 55 | 55 | Rev. 6.4 | 6.4 |
| 56 | 56 | Rev. 6.5 | 6.5 |
| 57 | 57 | Rev. 6.6 | 6.6 |
| 58 | 58 | Rev. 6.7 | 6.7 |
| 59 | 59 | Rev. 6.8 | 6.8 |
| 60 | 60 | Rev. 6.9 | 6.9 |
| 61 | 61 | Rev. 7.0 | 7.0 |
| 62 | 62 | Rev. 7.1 | 7.1 |
| 63 | 63 | Rev. 7.2 | 7.2 |
| 64 | 64 | Rev. 7.3 | 7.3 |
| 65 | 65 | Rev. 7.4 | 7.4 |
| 66 | 66 | Rev. 7.5 | 7.5 |
| 67 | 67 | Rev. 7.6 | 7.6 |
| 68 | 68 | Rev. 7.7 | 7.7 |
| 69 | 69 | Rev. 7.8 | 7.8 |
| 70 | 70 | Rev. 7.9 | 7.9 |
| 71 | 71 | Rev. 8.0 | 8.0 |
| 72 | 72 | Rev. 8.1 | 8.1 |
| 73 | 73 | Rev. 8.2 | 8.2 |
| 74 | 74 | Rev. 8.3 | 8.3 |
| 75 | 75 | Rev. 8.4 | 8.4 |
| 76 | 76 | Rev. 8.5 | 8.5 |
| 77 | 77 | Rev. 8.6 | 8.6 |
| 78 | 78 | Rev. 8.7 | 8.7 |
| 79 | 79 | Rev. 8.8 | 8.8 |
| 80 | 80 | Rev. 8.9 | 8.9 |
| 81 | 81 | Rev. 9.0 | 9.0 |
| 82 | 82 | Rev. 9.1 | 9.1 |
| 83 | 83 | Rev. 9.2 | 9.2 |
| 84 | 84 | Rev. 9.3 | 9.3 |
| 85 | 85 | Rev. 9.4 | 9.4 |
| 86 | 86 | Rev. 9.5 | 9.5 |
| 87 | 87 | Rev. 9.6 | 9.6 |
| 88 | 88 | Rev. 9.7 | 9.7 |
| 89 | 89 | Rev. 9.8 | 9.8 |
| 90 | 90 | Rev. 9.9 | 9.9 |
| 91 | 91 | Rev. 10.0 | 10.0 |
| 92 | 92 | Rev. 10.1 | 10.1 |
| 93 | 93 | Rev. 10.2 | 10.2 |
| 94 | 94 | Rev. 10.3 | 10.3 |
| 95 | 95 | Rev. 10.4 | 10.4 |
| 96 | 96 | Rev. 10.5 | 10.5 |
| 97 | 97 | Rev. 10.6 | 10.6 |
| 98 | 98 | Rev. 10.7 | 10.7 |
| 99 | 99 | Rev. 10.8 | 10.8 |
| 100 | 100 | Rev. 10.9 | 10.9 |

| ITEM | DESCRIPTION | REVISION |
|------|-----------------|----------|
| 1 | Initial Release | 1.0 |
| 2 | Rev. 1.1 | 1.1 |
| 3 | Rev. 1.2 | 1.2 |
| 4 | Rev. 1.3 | 1.3 |
| 5 | Rev. 1.4 | 1.4 |
| 6 | Rev. 1.5 | 1.5 |
| 7 | Rev. 1.6 | 1.6 |
| 8 | Rev. 1.7 | 1.7 |
| 9 | Rev. 1.8 | 1.8 |
| 10 | Rev. 1.9 | 1.9 |
| 11 | Rev. 2.0 | 2.0 |
| 12 | Rev. 2.1 | 2.1 |
| 13 | Rev. 2.2 | 2.2 |
| 14 | Rev. 2.3 | 2.3 |
| 15 | Rev. 2.4 | 2.4 |
| 16 | Rev. 2.5 | 2.5 |
| 17 | Rev. 2.6 | 2.6 |
| 18 | Rev. 2.7 | 2.7 |
| 19 | Rev. 2.8 | 2.8 |
| 20 | Rev. 2.9 | 2.9 |
| 21 | Rev. 3.0 | 3.0 |
| 22 | Rev. 3.1 | 3.1 |
| 23 | Rev. 3.2 | 3.2 |
| 24 | Rev. 3.3 | 3.3 |
| 25 | Rev. 3.4 | 3.4 |
| 26 | Rev. 3.5 | 3.5 |
| 27 | Rev. 3.6 | 3.6 |
| 28 | Rev. 3.7 | 3.7 |
| 29 | Rev. 3.8 | 3.8 |
| 30 | Rev. 3.9 | 3.9 |
| 31 | Rev. 4.0 | 4.0 |
| 32 | Rev. 4.1 | 4.1 |
| 33 | Rev. 4.2 | 4.2 |
| 34 | Rev. 4.3 | 4.3 |
| 35 | Rev. 4.4 | 4.4 |
| 36 | Rev. 4.5 | 4.5 |
| 37 | Rev. 4.6 | 4.6 |
| 38 | Rev. 4.7 | 4.7 |
| 39 | Rev. 4.8 | 4.8 |
| 40 | Rev. 4.9 | 4.9 |
| 41 | Rev. 5.0 | 5.0 |
| 42 | Rev. 5.1 | 5.1 |
| 43 | Rev. 5.2 | 5.2 |
| 44 | Rev. 5.3 | 5.3 |
| 45 | Rev. 5.4 | 5.4 |
| 46 | Rev. 5.5 | 5.5 |
| 47 | Rev. 5.6 | 5.6 |
| 48 | Rev. 5.7 | 5.7 |
| 49 | Rev. 5.8 | 5.8 |
| 50 | Rev. 5.9 | 5.9 |
| 51 | Rev. 6.0 | 6.0 |
| 52 | Rev. 6.1 | 6.1 |
| 53 | Rev. 6.2 | 6.2 |
| 54 | Rev. 6.3 | 6.3 |
| 55 | Rev. 6.4 | 6.4 |
| 56 | Rev. 6.5 | 6.5 |
| 57 | Rev. 6.6 | 6.6 |
| 58 | Rev. 6.7 | 6.7 |
| 59 | Rev. 6.8 | 6.8 |
| 60 | Rev. 6.9 | 6.9 |
| 61 | Rev. 7.0 | 7.0 |
| 62 | Rev. 7.1 | 7.1 |
| 63 | Rev. 7.2 | 7.2 |
| 64 | Rev. 7.3 | 7.3 |
| 65 | Rev. 7.4 | 7.4 |
| 66 | Rev. 7.5 | 7.5 |
| 67 | Rev. 7.6 | 7.6 |
| 68 | Rev. 7.7 | 7.7 |
| 69 | Rev. 7.8 | 7.8 |
| 70 | Rev. 7.9 | 7.9 |
| 71 | Rev. 8.0 | 8.0 |
| 72 | Rev. 8.1 | 8.1 |
| 73 | Rev. 8.2 | 8.2 |
| 74 | Rev. 8.3 | 8.3 |
| 75 | Rev. 8.4 | 8.4 |
| 76 | Rev. 8.5 | 8.5 |
| 77 | Rev. 8.6 | 8.6 |
| 78 | Rev. 8.7 | 8.7 |
| 79 | Rev. 8.8 | 8.8 |
| 80 | Rev. 8.9 | 8.9 |
| 81 | Rev. 9.0 | 9.0 |
| 82 | Rev. 9.1 | 9.1 |
| 83 | Rev. 9.2 | 9.2 |
| 84 | Rev. 9.3 | 9.3 |
| 85 | Rev. 9.4 | 9.4 |
| 86 | Rev. 9.5 | 9.5 |
| 87 | Rev. 9.6 | 9.6 |
| 88 | Rev. 9.7 | 9.7 |
| 89 | Rev. 9.8 | 9.8 |
| 90 | Rev. 9.9 | 9.9 |
| 91 | Rev. 10.0 | 10.0 |
| 92 | Rev. 10.1 | 10.1 |
| 93 | Rev. 10.2 | 10.2 |
| 94 | Rev. 10.3 | 10.3 |
| 95 | Rev. 10.4 | 10.4 |
| 96 | Rev. 10.5 | 10.5 |
| 97 | Rev. 10.6 | 10.6 |
| 98 | Rev. 10.7 | 10.7 |
| 99 | Rev. 10.8 | 10.8 |
| 100 | Rev. 10.9 | 10.9 |